INTEGRATION PROJECT
EXPERT PANEL

Closeout Report for Panel Meeting Held September 15 – 17, 1999

Prepared by the Integration Project Expert Panel

Panel Members:

Prof. R. L. Bassett
Dr. Edgar Berkey, Panel Chairman
Dr. John G. Conaway
Prof. James R. Karr
Dr. Michael C. Kavanaugh, Panel Vice-Chairman
Dr. John Matuszek
Mr. Ralph O. Patt
Dr. Peter J. Wierenga

Prepared for

U.S. Department of Energy
Bechtel Hanford, Inc.

November 5, 1999

Table of Contents

Executive Summary

Significant progress has been made by the Integration Project (IP) over the past year. Some areas, such as the Science and Technology (S&T) effort, have progressed smoothly and rapidly and have achieved impressive early results. In recent months we have seen more signs that the idea of integration is gradually gaining acceptance and support. The new Site Manager, Keith Klein, has announced a reorganization intended to reduce stovepiping, suggesting a new, site-wide emphasis on integration. One session of the Integration Project Expert Panel (IPEP) September 1999 meeting was attended by DOE Under Secretary Dr. Ernest Moniz, DOE Assistant Secretary for Environmental Management Dr. Carolyn Huntoon, Site Manager Klein, and other senior managers. This was a clear indication of their support for the goals of the IP, as well as for the IPEP's role in the integration process.

However, progress has not been uniformly good across all IP activities, and the high level of performance demonstrated by the S&T team and a few others must now become the standard for the IP as a whole. IPEP members remain very concerned about the System Assessment Capability (SAC), which was described in earlier IP documents as the critical path of the Project. The descriptions of the SAC in the latest version of the Project Description and other documents are still nebulous.

The IP must seize every opportunity to improve efficiency, focus its efforts on true integration, and move the process forward at an increasing pace. For our part, the IPEP will be trying some new initiatives for FY00 IPEP meetings, aimed in part at improving communication with the Project and increasing the effectiveness of the IPEP. For example, it is important for the IPEP to be involved in issues early enough to affect outcomes, not just review work that has been completed and published, and we will work with IP personnel to accomplish that goal.

Early in FY99, the IPEP presented a list of four initial focus areas of primary concern to us at that time. We recently selected four new focus areas which we will emphasize beginning with our first FY00 IPEP meeting, planned for January 2000. These four new focus areas are Project Management, Characterization of Systems, Modeling and Transport, and Subsurface Investigations. These areas are important for long-term IP success and are of immediate concern to us.

Some of the recurring themes in our focus area sessions will be priority and objective setting, effective and efficient use of resources, technical and scientific quality, progress and urgency of work effort, and how information is interpreted and used for decision support. The focus areas represent one opportunity for the IPEP to move beyond formal review of documents and discussion of overview-type presentations at meetings. It is our intent that focus area meetings will be similar to the Subpanel meetings of FY99 in level of detail and will give us additional opportunities for interaction with stakeholders and Tribal Nations on specific technical topics.

Under the Project Management Focus Area, the IPEP will consider overarching management-related issues that can have an important effect on IP success. Several areas that fit those criteria are management structure, resources, the SAC, peer review

processes, risk, decision-making under uncertainty, and monitoring the IP's response to earlier recommendations.

The stated purpose for the IP's *Characterization of Systems* activity is to coordinate and optimize the collection and integration of data characterizing the vadose zone, groundwater, and Columbia River. The IPEP Characterization of Systems Focus Area is somewhat broader than that, extending also to certain topics in the area of inventory of potential contaminants currently in storage. Under this focus area, the IPEP will encourage new and innovative approaches for characterizing chemical and radiological inventories in the vadose and saturated zones and the River, characterizing geologic structure and hydrologic conditions of the vadose and saturated zones, and characterizing conditions (e.g., hydrologic, sediment, contaminant) in the Columbia River. The need for a site-wide comprehensive inventory assessment will also be part of this focus area.

Under the Modeling and Transport Focus Area, the IPEP will consider various topics dealing with conceptual models and computer modeling of the subsurface transport of contaminants from the source through the vadose zone and groundwater and into the Columbia River, along with the transport characteristics of the contaminants in the various geohydrologic zones. Included will be consideration of the need for, and the characteristics of, a single site-wide conceptual model, issues surrounding the selection of suitable vadose zone computer models, the development of data sets for testing models, and the question of eventual integration of the modeling effort across the Site.

In the Subsurface Investigations Focus Area, the IPEP will initially concentrate on borehole emplacement, borehole sampling, and *in-situ* measurements in boreholes. Key issues in the area of drilling technology include gaining access to the region beneath structures such as underground storage tanks, assessing low concentrations of contaminants below high-concentration zones, and reducing the high cost per borehole of drilling. We will be urging the IP to stress better methods for optimizing the use of new and existing boreholes because of the great investment each borehole represents, and making better use of existing data.

Summary of IPEP recommendations given in this report.

The following brief summary of formal IPEP recommendations is for the reader's convenience. The full text of the recommendations at the end of the report should be consulted for clarity.

1. Resolve the objectives and potential uses of the SAC, Rev. 0, as quickly as possible.

2. Publish an analysis of lessons learned throughout the first S&T proposal cycle. Publish an updated development schedule showing how the important S&T work that will not be funded through the EMSP process will be handled.

3. Report on how well the EMSP awards have addressed the SAC's most urgent technical and data needs and whether any new gaps have been identified

4. Formalize the process of identifying essential S&T needs not addressed by EMSP funding and ensure that required funding is secured.

5. Address the problems identified in Site-wide data systems by the Peer Review Panel on the Proposed Hanford Site-Wide Groundwater Model.

6. Vigorously pursue the goal of a single site-wide conceptual model that is allowed to evolve along a single path under configuration control.

7. Develop a proposal to integrate computational transport modeling across the site so eventually there is a single center of modeling excellence.

8. Hold workshops in key technical areas where differing opinions are the norm, such as vadose zone modeling and decision-making under uncertainty.

9. Address more vigorously cost savings, including in the areas of bureaucratic overhead, the high cost of drilling, and the expensive groundwater monitoring program.

10. Work proactively with the Panel to improve communication, remove institutional barriers, and identify early schedule points for IPEP involvement in issues.

11. Assign responsibility to one person to keep IPEP members informed of relevant peer review activities, workshops, release of major documents, and similar events.

Overview

The fifth meeting of the Integration Project Expert Panel (IPEP) was held September 15 – 17, 1999. Because this meeting took place near the end of the fiscal year, discussions included a review of progress for FY99 as well as plans for FY00 and beyond.

Encouraging signs

One session of the IPEP meeting was attended by DOE Under Secretary Dr. Ernest Moniz, DOE Assistant Secretary for Environmental Management Dr. Carolyn Huntoon, Hanford Site Manager Keith Klein, and other senior managers. In our view, their attendance at this IPEP meeting demonstrates their support for the goals of the Integration Project (IP), as well as for the IPEP's role in the integration process.

In recent months, we have seen more signs that the idea of integration is gradually gaining acceptance and support at Hanford. For example, IPEP members involved in Subpanel meetings have generally reported that many participants inside and outside the Integration Project were clearly enthusiastic about the IP, about existing levels of cooperation, and about the potential for success. Subpanel meetings have generally been smaller and less formal than full IPEP meetings, so this enthusiasm and spirit of cooperation comes across more readily in that venue. As another example, in announcing his recent reorganization, the new Site Manager indicated his goal was to "… reduce stovepiping and create an environment where all organizations must work interdependently to ensure our collective success." This attitude on the part of top management is encouraging to us and seems to indicate a new, site-wide emphasis on integration.

IPEP members believe significant progress has been made over the past year by the IP, slowly at first and then with some signs of gathering momentum. Some areas, such as the Science and Technology (S&T) effort, have progressed smoothly and rapidly and achieved impressive early results. Under Secretary Moniz and several others left the IPEP meeting late in the afternoon of the first day to announce the Environmental Management Science Program (EMSP) awards that were based in part on needs identified by the IP's S&T effort. These awards provide a notable indicator of success for the S&T team's work to date.

In general, IPEP members felt that IP personnel have done a good job improving documents, including the State of Knowledge, the Project Description (formerly the Project Specification), and the Science and Technology Plan. We saw ample evidence that constructive comments provided on earlier drafts were thoughtfully considered in the production of these latest versions, which now are more robust communication and planning tools. There are still some weak points, however, most notably in sections dealing with the System Assessment Capability (SAC).

The IP has consistently stressed the importance of public participation and efforts in this regard have represented an encouraging break from usual Hanford procedure. This

process has not always gone smoothly and has undoubtedly introduced some delay, but it should pay dividends later. Similarly, IP personnel have encountered a variety of institutional barriers that have slowed and complicated the transition to a more integrated mode of operation. Still, with the strong support of Under Secretary Moniz, progress is being made in overcoming those barriers, and it is reasonable to expect the rate of progress to increase now under the new Hanford Site Manager.

IPEP concerns

The S&T initiative leading up to the EMSP awards that benefit Hanford represents a clear success for the IP. Some other efforts have not gone so well, however, and the high level of performance demonstrated by the S&T team and a few others must now become the standard for the IP as a whole. IPEP members remain concerned about the SAC, which was described in the earlier Project Specification as "the critical path activity for the Integration Project" (DOE, 1998). The descriptions of the SAC in the latest version of the Project Description and other documents are still nebulous, and in fact have changed little from earlier versions. The IPEP was told that a new document dealing with the SAC would be released about two weeks after the September meeting. We had hoped for a substantive update briefing and discussion at the meeting session devoted to the SAC. Instead, we were restricted by IP management from asking questions related to this new material, which was said to be in the final editorial stages but nonetheless kept confidential from us. IPEP members were more than a little disturbed by what seemed to be an inappropriate level of secrecy surrounding an issue that should have been open to discussion.

Although a major document on the SAC was scheduled for release shortly after our meeting, there has nonetheless been ongoing discussion inside the IP of the need to shift to a "Plan B" approach. The SAC is not intended to be used to "inform and influence decisions" until the third quarter of FY2002. At issue is whether the SAC will be used to aid in any of the important decisions that will be made in the next 30 months. According to the existing plan, this will not happen because IP managers are concerned that Rev. 0 will not yet be a reliable and proven decision-making tool. On the other hand, Site Manager Klein has made it clear that he would like the IP to begin contributing to the decision making process as quickly as possible. We urge IP managers to resolve the objectives and potential uses of SAC, Rev. 0, as quickly as possible. We urge them to be aggressive in their planning, to set the goal as high as might feasibly be achieved, and then spare no effort reaching that goal. The SAC report will be reviewed by some IPEP members. This is especially important in light of the rather low expectation that the SAC now has of Rev 0 as a proof-of-concept exercise rather than an immediately useful evaluation.

While the EMSP awards represented a major step forward for the S&T process, we are still concerned about other aspects of S&T. For example, the latest S&T plan (DOE, 1999a) lists numerous complex activities with short timelines. Many seemingly interdependent activities will be conducted in parallel, with the products from some activities required by other activities that end at about the same time. Given the fact that the IP has a very limited budget and little control over activities conducted under the

auspices of external groups, such as EMSP, it is difficult to imagine a mechanism that will allow these very ambitious plans to be broadly successful.

We have heard little about other important technical developments that will not be funded through the EMSP mechanism. Now that the EMSP awards have been announced, the IP should announce an updated development schedule with revised priorities and specifics regarding the allocation of internal and external funds. The S&T updates we have received have been full of good ideas but have been short on specifics beyond the EMSP process.

This was the first full meeting of the IPEP under our new meeting ground rules, introduced partway through the May IPEP meeting and modified slightly for the September meeting. Under this new, more formal mode of operation, speakers are given a fixed amount of time and are interrupted by IPEP members only for questions of clarification. The presentation is followed by a period of questions and answers, and general discussion, among IPEP members, the speaker, and fellow team members of the speaker. While this approach has generally been well received, again at this meeting, IPEP members were sometimes frustrated by a lack of depth to the briefings and ensuing discussions. It is evident we still have work to do in optimizing our format for information exchange, and we believe doing so will improve the effectiveness of the IPEP. Because of these and other concerns, we will be trying some new initiatives for FY00 IPEP meetings.

It is important for the IPEP to be involved in issues early enough to affect outcomes, not just review work that has been completed and published, at which stage major changes in direction become much more costly in time and money. IP managers have been reluctant to present tentative plans and technical ideas that have not been thoroughly vetted internally, presumably fearing possible embarrassment or loss of credibility. Nonetheless, in our view the possibility of embarrassment is outweighed by the importance of accelerating the rate of progress of the IP, not in terms of increasing effort, which has often been impressive, but in terms of increasing effectiveness. The IP must seize every opportunity to improve efficiency and move the process forward at an increasing pace.

New IPEP Focus Areas

Early in FY99, the IPEP presented a list of four initial focus areas of primary concern at that time (IPEP, 1999a). Each of those focus areas resulted in formation of a Subpanel, and the IPEP determined that three of the Subpanels had immediate enough concerns that formal meetings was held by each of those three during FY99[1] (IPEP, 1999b; IPEP 1999c; IPEP 1999d)). Those initial focus areas were

1. Risk and Interaction with Stakeholders and Tribal Nations,
2. Peer Review Processes,
3. Modeling of Vadose Zone and Groundwater, and

[1] The meetings of the two Modeling Subpanel members with members of the groundwater modeling peer review panel were essentially liaison activities that did not result in a report.

4. Field Investigations and Data Gathering.

At the IPEP caucus in Chicago on the weekend of August 28-29 1999, we developed a list of fourteen topic areas that we consider to be of greatest importance to success of the IP at the present time. From that list, we selected four new focus areas which we will emphasize beginning with our first FY00 IPEP meeting, planned for January 2000. These four new focus areas are:

1. Project Management,
2. Characterization of Systems,
3. Modeling and Transport, and
4. Subsurface Investigations.

To narrow the fourteen topic areas to four focus areas, we developed a the following set of selection criteria.

- The selected focus areas should enable us to deal with the areas of greatest current importance to IP success,
- focus on issues with the highest degree of uncertainty,
- focus on areas where we can have a significant impact on IP outcomes, and
- examine unresolved issues involving differing interpretations.

The four new focus areas are important for long-term IP success and are areas of immediate concern to us. At the same time that we developed this short list of focus areas, we also considered whether other topic areas on the longer list of fourteen needed our attention, and we will develop mechanisms to deal with those as needed.

It may be useful to discuss briefly how the original four focus areas relate to the four new focus areas.

Risk and Interaction with Stakeholders and Tribal Nations are actually two separate topic areas that were handled by one Subpanel. Interaction with stakeholders and Tribal Nations is an ongoing concern of the IPEP that we now classify more accurately as a liaison activity. We expect there will be little change in the actual operations in this area. For the present, we will monitor progress on the part of the IP in the risk topic area under the new Project Management Focus Area.

Peer Review Processes will now be considered as part of the new Project Management Focus Area.

Modeling of Vadose Zone and Groundwater will generally be subsumed into the new Modeling and Transport Focus Area. However, for the present the groundwater modeling portion will be dealt with largely by assigning an IPEP member as liaison to the existing Peer Review Panel on the Proposed Hanford Site-Wide Groundwater Model.

Field Investigations and Data Gathering scope will be handled partly by the Subsurface Investigations Focus Area and partly by the Characterization of Systems focus area.

There is a great deal of potential overlap among these four focus areas, which we will deal with as the need arises. For example, in general, drilling, sampling, logging, and making the initial interpretation of a single set of subsurface data will fall into Subsurface Investigations, while subsequent larger-scale data integration, modeling (other than subsurface flow and transport), and similar activities will fall into Characterization of Systems. However, some data collection is equally important for model testing and thus could sometimes become a topic for Modeling and Transport. As another example, while the Project Management Focus Area includes the general issue of decision making under uncertainty, the Characterization of Systems Focus Area may look at methodologies for dealing with uncertainty in systems characterization and remedial action decisions.

It is important to remember that these remarks and the discussions below on each of the focus areas represent our early thinking on FY00 IPEP activities. Our plans will evolve and become more specific as the year progresses. Because these focus areas are still quite broad, we will not attempt to deal in depth with all of the issues described here but instead will select specific subtopics to pursue.

Issues

Some of the recurring themes in each of the four new focus areas will be:

- priority and objective setting,
- effective and efficient use of resources,
- technical and scientific quality,
- progress and urgency of work effort, and
- decision support.

Goals

This revision of our list of primary focus areas is part of a continuing effort on our part to deal with the most pressing issues, improve the effectiveness of the IPEP, and lend greater assistance to the IP. Many of our interactions with IP personnel to date have been in the form of either formal review of documents or discussion of overview-type presentations at meetings. Working with IP personnel, we must continue to develop better methods to engage in an intensive exchange of ideas and opinions on issues that are still in flux, with the goals of improving the IPEP's understanding of the problems and challenging IP personnel always to think creatively and act effectively in developing solutions to particularly vexing problems. For example, we have found that last year's smaller Subpanel meetings were superior to full IPEP meetings in terms of a free ranging exchange of information and ideas. It is our intent that focus area meetings held in FY00 will be similar in level of detail. The focus areas will also give us additional opportunities for interaction with stakeholders and Tribal Nations, and their concerns will be factored into our prioritization of focus area topics.

Project Management Focus Area

At present, the IPEP leads for the Project Management Focus Area are Edgar Berkey and James Karr.

Scope and issues

In this focus area, we will consider overarching management-related issues, such as the ones discussed briefly here that can have an important effect on IP success.

Management structure

We have repeatedly raised the question whether integration under the IP is taking place at a sufficiently high level and is adequate in scope to optimize efficiency and cost savings across the site. For example, the Peer Review Panel on the Proposed Hanford Site-Wide Groundwater Model observed that the Hanford Environmental Information System "… is not serving the essential needs of geologists and engineers at a variety of scales …" (Gorelick et al., 1999). This panel recommended "… that a better mechanism be established for the entire Hanford complex to centralize data." We know that the IP is pursuing some initiatives relevant to these points, and we will explore these in more depth under the auspices of the IP.

Resources and cost savings

We have not seen a robust discussion of issues related to the availability and application of resources. In particular:

- What is the reasoning behind the long-term budget projections?
- What are the assumed endpoints?
- Is the projected budget realistic?
- Will S&T initiatives deliver needed technology when required?

We are concerned about finding economies in activities that are particularly costly. For example, costs associated with the groundwater monitoring program are currently quite high, the high cost of drilling drastically reduces potential field activities, and the cost of management overhead must be carefully controlled.

System Assessment Capability

We are troubled by the unimpressive history of the SAC and plan to follow evolving SAC plans closely. We will review the letter report on SAC scheduled for release at the beginning of FY00, the SAC design document scheduled for release in 4/00, and the SAC Rev 0 when it is released in FY01. Following our review of the SAC letter report, we will engage IP personnel in a dialog on plans, progress, and whether a SAC "Plan B" could realistically produce the ability to support any upcoming site decisions sooner than the third quarter of FY02 as currently planned.

Peer review processes

We opened discussions with IP personnel regarding peer review processes by means of a one-day Peer Review Processes Subpanel meeting in March 1999 (IPEP, 1999c). This discussion of review processes within the Integration Project and at the interfaces between the IP and the Core Projects will be continued under the auspices of the Project Management Focus Area. We will begin by discussing the IP's response to the review recommendations put forth in the meeting closeout report for the March 1999 Peer Review Processes Subpanel meeting (IPEP, 1999c).

Risk

The issue of risk is of major importance to the IP as indicated by our selection of this as a focus area last year. The IPEP held a one-day Risk Subpanel meeting on April 30 1999 at Hanford (IPEP, 1999d). Our focus on this topic seems to have helped stimulate IP activities on risk over the past 6 months. We have seen a number of presentations and documents dealing with the IP's plans in the area of risk and will maintain an ongoing dialog on plans and progress, including progress toward at least conceptual agreement with stakeholders, regulators, and Tribal Nations. We will track IP progress in this area.

Uncertainty

Over the past year, the IPEP has emphasized the importance of developing the capability to make defensible decisions in the presence of uncertainty. We will continue to discuss this topic with IP personnel and others, and would like an update on plans in this area. There may be merit in the idea of the IP conducting a workshop on decision-making under uncertainty.

Contamination of terrestrial environments

The IP emphasizes the downward and horizontal movement of various chemical and radiological contaminants toward the Columbia River from sources, such as tanks and cribs, throughout Hanford. Recent discoveries of insects (e.g., ants) and plants (e.g., tumbleweeds) carrying radioactive contamination shows that some movement may be vertical and enhanced by the biota. Although the amount of this movement may be small today, its potential long-term consequences cannot be ignored either in the definition of cleanup strategies or in the development of decisions about future Hanford land use. To be truly integrative, the IP should carefully evaluate the effects of current and future contaminant movement to terrestrial systems.

IP response to earlier recommendations

IPEP members have stated on various occasions that we do not expect our recommendations to be followed blindly by the IP. The IP may have excellent justification for modifying or rejecting a recommended action. However, it is incumbent upon the IPEP to monitor the IP's response to our recommendations and revisit those issues from time to time to ensure that the IP's approach is achieving success. That activity will fall into the Project Management Focus Area. Similarly, the IP was criticized

by DOE/HQ early in FY99[2] for "… lack of progress in addressing deliverables recommended by the SX Expert Panel". Since that earlier panel was in some ways the predecessor of the IPEP, it behooves the IPEP to monitor progress on those earlier recommendations as well, and this will also fall under the Project Management Focus Area.

Characterization of Systems Focus Area

At present, the IPEP leads for the Characterization of Systems Focus Area are Michael Kavanaugh and John Matuszek.

Scope

The role of the IP's *Characterization of Systems* activity is to coordinate and optimize the collection and integration of data characterizing the vadose zone, groundwater, and Columbia River (DOE, 1999b). The IPEP Characterization of Systems Focus Area encompasses all components of the system at Hanford, including the tanks, basins, canyons and other structures containing potential environmental contaminants; along with the structure of and contaminants contained in the vadose zone, the saturated zone, and the Columbia River.

Major project decisions[3] hinge on the outcome of various characterization efforts either already completed, currently underway, or planned for the future. Successful use of system engineering techniques for making such decisions requires adequate systems characterization data. Characterization of systems now is a key component of the Integration Project, and we have established this corresponding focus area.

Issues

Under the Characterization of Systems focus area, we will consider selected plans, tasks, issues, and deliverables that affect the characterization of systems at Hanford, such as the following examples.

Comprehensive inventory assessment

One of the major challenges at Hanford is establishing estimates of total site inventory with a level of accuracy consistent with the various uses planned for this information. We are not aware of any comprehensive assessment of inventory at Hanford that brings together all of the major components, including inventory in the tanks and other facilities as well as in the vadose zone, groundwater and the Columbia River. The effort expended to date on inventory has been substantial and the continuing lack of a broadly accepted total inventory assessment complicates many site issues. It is important that the issue of a site-wide inventory be addressed vigorously; characterization of systems offers a good opportunity to demonstrate the benefits of site-wide integration in this task.

[2] Letter from J.M. Owendoff to J.D. Wagoner, dated 11/24/98

[3] For example, retrieval of high-level waste from underground storage tanks, acceptable levels of residual contaminants following remediation or retrieval from tanks, remedial actions for groundwater and soil contamination, assessment of cumulative effects due to possible chemical or radiological exposure, the extent of long term institutional controls, if warranted, and strategies for closure of some or all of the site

The IPEP is primarily concerned with contaminants as they move into and through the vadose zone, the groundwater, and the river. In the case of the more-or-less controlled inventories, such as wastes in tanks or spent fuel in basins, our main interest is in the portions of those inventories that may eventually enter the environment, such as during removal from their current containment facilities or as residues that are not feasible to remove. Innovative techniques and instrumentation must be brought to bear if the current uncontained subsurface inventory is to be resolved with a level of uncertainty that will permit decisions to be made ranging from those related to tank-waste removal to those bearing on land use at the closure of the remediation effort.

Uncertainty

While the Project Management Focus Area includes the general issue of decision making under uncertainty, the Characterization of Systems Focus Area may look at methodologies for dealing with uncertainty in system characterization and remedial action decisions.

Characterization methodologies

A number of characterization methodologies may be considered under this focus area, including methods for characterizing geologic structure and hydrologic conditions of the vadose and saturated zones, methods for characterizing conditions (e.g., hydrologic, sediment, contaminant) in the Columbia River, and methods for characterizing chemical and radiological inventories in the vadose and saturated zones and the River. This is also an area of broad overlap with the Subsurface Investigations Focus Area.

Thermal modeling

We have heard informally that some success has been achieved in using relatively simple numerical models to perform some of the thermal calculations recommended by the earlier Vadose Zone Expert Panel (Conaway et al., 1997; Conaway et al., 1998). Thermal analysis has the theoretical potential for providing estimates of bulk radionuclide inventory in those parts of the vadose zone where subsurface contaminant concentration and/or contaminated soil volume are large, that is, for those subsurface regions that contribute most heavily to uncontained radionuclide inventory in the vadose zone. Although this work is currently somewhat speculative, it has important potential applications so we will monitor it under this focus area.

We understand that a scoping report is forthcoming regarding the use of borehole thermal measurements and modeling for characterization of heat-generating radioactive contaminants in the vadose zone between and below tanks SX-108 and SX109, near the research drywell/borehole 41-09-39. Because this tank farm, and tank SX-108 in particular, figure prominently in the proposed ORP Vadose Zone Characterization Program, we may review this report.

Assessment of biological effects

A major goal for the IP, and for cleanup activities at Hanford, is to understand the location and movement of contaminants and to take actions to reduce or avoid

exposures that pose risks to human and ecological health. Any effort to do that must begin by determining where the contaminants with potential health consequences might be and where they are going. It is also necessary to understand what organisms are exposed and the effects of those exposures. Because the river is central to these assessments, knowledge of the movement of contaminants to the river is essential.

It is equally critical to document the biological responses to those exposures, so priorities can be assigned for cleanup activities. The consequences of exposure, such as decline of salmon, may be direct, for example the failure of salmon eggs to develop, or indirect, as when mortality of benthic invertebrates in streams leaves fish without reliable food supplies. The consequences may be immediate, as in the case of humans exposed to contaminants in soil or water, or delayed and even remote, such as the consumption of contaminated fish. Knowledge of the pathways of exposure should be derived from an understanding of the influence of physical, chemical, and biological events and processes.

The IP must strive to avoid arbitrary exclusion of any of the dimensions of exposure and risk to human and ecological health. In short, they must track and identify where the contaminants are moving and how, when and where they are likely to influence receptors of concern, and what are likely to be the expected responses of those receptors, including population-level phenomena as well as higher order (ecosystem) effects.

Other issues

In the short term, at least three pending reports will likely be reviewed under this focus area: FEP protocols (scheduled for release 12/99), Interim Inventory Report (scheduled for release 3/00), and Interim risk characterization report (also scheduled for release 3/00). Other issues of importance include an assessment of groundwater remediation options and the role of characterization in remediation system optimization.

While the 1999 EMSP Research awards provide an important start toward promoting new ideas into the agency-wide remediation program, we note that apparently only four of the thirty one awards relate to inventory characterization, and those four are rather narrow in scope (two for ^{99}Tc and one each for non-aqueous phase liquids (NAPLs) and dense non-aqueous phase liquids (DNAPLs)). These funded projects represent only a small fraction of the information needed for decision making at Hanford.

We note that in a recent interview, the Manager of the Office of River Protection is quoted as saying that he is more concerned with emptying the tanks and removing the specter of further leaks than assessing what has already leaked out[4]. While no one can deny the need to reduce the danger of future leaks, in the past, Hanford management has used this need as a pretext to essentially dismiss contamination of the vadose zone as being an issue of little importance. This shortsighted view ignores the importance of reducing the uncertainty associated with the inventory of currently uncontrolled contaminants. The contaminants that have already escaped must be factored into any

[4] Seattle Times, October 19, 1999

assessment of the impact of additional leakage that could occur while emptying the tanks as well as the potential impact of residual contaminants following retrieval.

Modeling and Transport Focus Area

At present, the IPEP leads for the Modeling and Transport Focus Area are Peter Wierenga and Randy Bassett.

Scope and goals

Although the initial emphasis will be on vadose zone modeling, groundwater and river modeling issues must also be addressed. One IPEP member will act as liaison with the existing Peer Review Panel on the Proposed Hanford Site-Wide Groundwater Model.

Modeling of vadose zone flow and transport processes is an important component of vadose zone characterization and clean-up as well as an essential tool for making long term predictions of contaminant transport through the vadose zone to groundwater. Modeling is needed for risk analysis, in developing the SAC, and for planning and analyzing the results of field and laboratory experiments.

The Modeling and Transport Focus Area includes conceptual models and computer modeling of the subsurface transport of contaminants from their sources through the vadose zone and groundwater and into the Columbia river, along with the transport characteristics of the contaminants in the various geohydrologic zones. This is a broad area but, as with the other focus areas, we will be concentrating on certain key factors. We will also make use of whatever resources are available to leverage our efforts, such as relying on the existing Peer Review Panel on the Proposed Hanford Site-Wide Groundwater Model as our primary source of review information on groundwater modeling efforts.

Our first goal in this focus area is to understand more clearly what the IP's plans are with regard to transport modeling inside the IP (in the SAC and in terms of the S&T effort) and outside the IP (in terms of plans for coordinating IP modeling with other modeling efforts or, better still, integrating modeling across the site so eventually there is a single center of modeling excellence that handles most of the transport modeling work). Our second goal is to ensure that current plans are reasonable and defensible in terms of cost, schedule, and projected quality of results.

Issues

Below is a list of some of the issues currently of concern in the Modeling and Transport Focus Area.

Conceptual models

It does not make sense to have conceptual models for, say, contaminant transport in the Hanford vadose zone, that vary from project to project or from one key document to another. This is a sign of subjective thinking and a lack of institutional rigor, and does not inspire confidence. Although using different computational models for different purposes and conditions is probably unavoidable at least for the present, the IP must

strive for a single site-wide conceptual model that is allowed to evolve along a single path under configuration control. We will monitor progress in this area.

State of the transport modeling effort

Currently, responsibility for transport modeling in the IP is concentrated in the SAC, with the S&T team responsible for providing development products to aid in that effort. There does not appear to be a clear responsibility for coordinating field characterization investigations with modeling data requirements. We are concerned about the status of the SAC in general with the modeling effort being one of our key concerns, so we will review plans for development and implementation of the SAC modeling effort.

We are interested in how the S&T effort will feed needed modeling technologies and transport data, among other things, to the SAC on a timely basis. Because the S&T effort has now been through one cycle of the process of identifying needs, issuing requests for proposals, and selecting proposals for funding, we would like to hear how well the resulting EMSP awards have addressed the SAC's short-term needs and whether any new gaps have been identified in terms of delivery of modeling technology and data from the S&T effort.

Few flow models have been tested with field data, yet such testing is important for demonstrating model performance and enhancing confidence in modeling results. Few field data sets are currently available from well-controlled field experiments, especially for the deep vadose zone, a crucial issue for Hanford vadose zone modeling. It is not reasonable to assume that what is observed or predicted near the surface is valid throughout the vadose zone. Depositional processes have resulted in extensive layering of the subsurface at Hanford, and the effects of this layering on transport have not been adequately addressed.

Some of our specific questions in this area include the following:

- What is the extent of numerical flow and transport modeling currently underway among Core Projects and within the IP?
- Which groups or projects are responsible for the selection, operation, calibration, and peer review of these models and related databases?
- What is the status of these activities, including the modeling aspects of the SAC?
- Where does the responsibility lie for defining the data requirements of the SAC that can be fulfilled by Core Project characterization efforts?

Selection of Vadose Zone models

Groundwater and vadose zone modeling have played important roles in a number of projects across the DOE complex. As a result, a variety of vadose zone models are now available at Hanford and elsewhere in the complex, including at several National Laboratories. At the September 1999 IPEP closeout session, a number of these existing transport computer models were discussed briefly. Each model was developed

for a specific initial application and each has characteristics that distinguish it from the others. Some of our areas of interest here are:

- Are current vadose zone transport models adequate for the SAC's needs for the foreseeable future?
- Will one model do the job satisfactorily or is more than one needed?
- Are PNNL's models best for Hanford or do other models offer important advantages?
- Does the plan for model selection and perhaps modification take reasonable advantage of the S&T Program?
- Can recent theoretical advances in model development and existing codes at other facilities, whether universities, national labs, international efforts, or the private sector, make important contributions to the modeling effort?
- Can better use be made of computational advances inside or outside of the DOE complex, such as massively parallel architecture?

There is merit to the idea of the IP holding a vadose zone modeling workshop in the near future to consider various modeling issues relevant to Hanford and address questions such as the ones listed above. This workshop could be patterned in part after the S&T workshops held with notable success in FY99. If the decision is made to do so, care should be taken to establish mechanisms that will yield unbiased conclusions to the extent practicable. This sort of open process should help alleviate stakeholder concerns and would help address concerns raised by the earlier Vadose Zone Expert Panel that prompted them to recommend emphatically that future modeling efforts be put to an RFP process rather than continuing with the PNNL group that was then doing the work (Conaway et al., 1997). We must add a caveat, however. Any workshop that might be held is unlikely to be on the critical path of the modeling effort and progress should not be delayed in the area pending the outcome of a workshop. The workshop is an ancillary activity although potentially a very useful tool for determining data gaps and attaining perspective, communication and guidance.

Integration of the modeling effort

Concurrently with the development of the SAC modeling capability inside the Integration Project, other projects, such as TWRS/ORP, will be pursuing in parallel their own modeling work. While this fragmented approach may be reasonable for the present to avoid disrupting important projects or missing regulatory milestones, at some time in the future it would seem to make more sense to establish a site-wide center of excellence to coordinate the modeling under configuration control.

An integration effort is needed to develop common data bases and ensure that each model is adapted to use as much of the same data from those data bases as possible. Integration of modeling should ensure that the output from, say, a vadose zone transport model, is useful and suitable as input to a groundwater model. Integration is also needed to coordinate the process of defining the needs for specific data that could be obtained as the result of the various field data collection activities. While needed

integration could take several years to implement, the process should begin immediately.

Contaminant transport

Although the IPEP has not yet reached a consensus on how we will consider contaminant transport issues, one issue of particular concern to some members is the possible alteration of soil structure, moisture retention, and chemical characteristics of the soil by leaking hot, caustic brine. This is also a characterization issue and may also be considered under Subsurface Investigations.

Subsurface Investigations Focus Area

At present, the IPEP leads for the Subsurface Investigations Focus Area are John Conaway and Ralph Patt.

Scope and Issues

The Subsurface Investigations Focus Area encompasses a diverse variety of technologies and investigative methods ranging from backhoe excavations to electrical resistivity tomography (ERT) soundings, from cone penetrometers to straddle packer tests in boreholes. We will initially concentrate on borehole emplacement, borehole sampling, and *in-situ* measurements in boreholes. The recurring themes in our discussions will be the availability, efficacy, and cost-effectiveness of the technologies as well as the roles the IP can play in the development and deployment of needed technologies and their integration across the Hanford Site.

Subsurface data required by the SAC

At this time, the IP does not seem to have adequately addressed the issue of how the subsurface data needed by the SAC are going to be obtained. Under current plans, many or most of the borehole drilling and sampling programs over the coming years will not be under the control of the IP. Yet, these efforts will be critical to the success of the SAC and, thus, critical to the success of the IP. The IP must take an active role in planning these borehole programs, including incorporating plans to address SAC data needs, must monitor the progress of the work as it proceeds, must use the resulting data in SAC as effectively as possible, and must provide feedback to improve the technologies and procedures. Some successes have been achieved in this area, such as the agreement to obtain additional data during decommissioning of RCRA monitoring wells that are no longer useful, but such cooperative efforts are still in their infancy.

Drilling technology

Key issues at this time in the area of drilling technology include gaining access to the region immediately beneath structures such as underground storage tanks , assessing low concentrations of contaminants without dragdown from overlying high-concentration zones, and reducing the high cost of drilling. Estimating contaminant inventory in the vadose zone beneath the tanks and other structures will probably involve some combination of directional drilling (slant drilling and/or steerable drilling technology) and

the use of caissons and lateral boreholes. Hanford has little experience in directional drilling technology although some initiatives are underway (Williams et al., 1999), and we are somewhat encouraged by comments during recent IPEP meetings that slant-drilling is the preferred alternative for a borehole being considered for the FY00 ORP Vadose Zone Characterization Program.

In the past, assessing low concentrations of contaminants below high concentration zones has generally been addressed by starting at the surface with a large diameter borehole and then "telescoping" down to smaller diameters after passing through highly contaminated zones. Experience with this approach has often not been satisfactory because when low concentrations of contaminants are encountered at depth using this method they are often ascribed, without proof, to dragdown from above. Other approaches must be considered to alleviate this ambiguity, such as drilling vertically into and perhaps through the high concentration zone to sample that contamination, then angle drilling from beyond the flank of the plume to retrieve samples below the high concentration zone without passing through that zone. This approach also greatly reduces the risk that the borehole will carry significant contamination to groundwater.

Reducing the cost of drilling is a key area for potential cost savings. Borehole programs at Hanford frequently cost more than $1,000,000 per hole for drilling, sampling, and analysis, or more than $5000 per foot. While this sort of work will always be costly for a number of reasons, such as radioactive contamination and safety precautions necessary for drilling inside the tank farms, the huge expenses involved demand that the search for improvements and efficiencies be vigorous and unrelenting. Drilling development does not seem to have been included in the S&T planning but it is essential that this topic be listed high on the IP's list of priorities.

Sampling in boreholes

Physical sampling in boreholes includes sampling while drilling as well as sidewall sampling. The usual problems with sampling while drilling are poor sample recovery, sample alteration so the sample is not representative of *in-situ* conditions, and under-sampling so there is a high uncertainty in any conclusions based on data from the few available samples. More can be done at Hanford to address those problems.

An area of immediate concern to the IPEP is sidewall sampling after the borehole is finished or during decommissioning. Historically at Hanford, little has been done in this area, and it is admittedly technically challenging. Still, at upwards of $1,000,000 per new borehole, there is enormous incentive to maximize use of new boreholes, as well as to return to existing boreholes, of which there are some 800 in the tank farms alone, to obtain new samples.

In-situ measurements in boreholes

Logging and physical sampling tend to produce complementary results that together allow more reliable interpretations of subsurface conditions. Similarly, borehole logs are most effective when a suite of several different types of measurement are available from a given borehole. For example, in borehole 41-09-39 at SX tank farm, plots of neutron moisture data and drilling resistance data allowed a much more robust interpretation to

be made of the spectral gamma-ray log data than the spectral data alone would support. This kind of synergistic approach is important in borehole investigations and the IPEP will monitor the IP's efforts in this area.

At the September 1999 IPEP meeting, we heard brief and rather oblique remarks to the effect that prompt gamma (n,γ) logging was recently used successfully, a subject about which we would like to learn more. We have also heard that a new logging contract will be let in the near future; because the high-resolution spectral gamma-ray logging conducted over the past several years was singled out by the earlier Vadose Zone Expert Panel as a notable success (Conaway et al., 1997). We are keenly interested in learning how the IP plans to maintain this high level of technical achievement. Finally, we have heard that two people were brought in to review the Hanford logging program, and a verbal closeout of their findings was presented. This, too, is of interest under Subsurface Investigations.

Optimizing use of existing boreholes

It is vitally important that the use of the hundreds of existing boreholes for collecting more data be carefully examined because of the high cost of each additional borehole drilled. The baseline high-resolution spectral gamma-ray logging effort that was carried out over the last several years is one clear success that predates the IP. More recently, the use of precise temperature measurements of borehole casing was proposed by the previous Vadose Zone Expert Panel as a possible mechanism for helping to locate and estimate distributions of large concentrations of heat producing nuclides such as ^{137}Cs and ^{90}Sr (Conaway et al., 1997; Conaway et al., 1998). This appears to be at least a theoretical possibility and seems to merit further attention. Periodic logging of existing boreholes with neutron moisture probes might provide useful information regarding recharge and plume movement. The Groundwater Modeling Review Panel has stated that in groundwater modeling at Hanford, "one of the greatest sources of uncertainty lies in the estimation of recharge" (Gorelick et al., 1999). Effective approaches must be sought to gain a better understanding of this phenomenon.

Making better use of existing data

It is important that optimal use be made of existing data, which can hold unique and valuable information that can be unlocked with relatively little effort. For example, sophisticated interpretation of the rather crude historical gross gamma logging data has yielded a number of new clues regarding timing and progress of leaks and even nuclide-specific information based on decay rates determined from repeat runs in the same borehole over a number of years (e.g. Price, 1996).

More recently, a procedure for spectral "shape factor analysis", applied to spectral gamma-ray logs, was developed by DOE/GJ (MACTEC ERS) to help distinguish between gamma-emitting contaminants in the formation and contaminants on the borehole casing, which can be indicative of contamination drag down during drilling or other borehole transport of contamination. Shape factor analysis can be applied to many existing logs as well as to log data obtained in the future, but IPEP members are concerned that this analysis technique has not been adequately demonstrated.

Conclusions

Significant progress has been made by the IP over the past year, especially in the S&T effort, in efforts to bring the issue of risk into the early planning stages, and a few other areas. In recent months we have seen more signs that the idea of integration is gradually gaining acceptance and support, and the new Hanford Site Manager Keith Klein has announced a reorganization that seems to indicate a new, site-wide emphasis on integration.

Some other efforts by the IP have not gone so well. IPEP members remain very concerned about the SAC. The descriptions of the SAC in the latest version of the Project Description and other documents are still nebulous, and the issue of whether the SAC, Rev. 0, will be used as an aid in any decisions affecting Hanford remediation must be resolved quickly. The IP must seize every opportunity to improve efficiency and move the integration process forward at an increasing pace.

According to existing plans, the IP seems to have been relegated to a very restricted role in integrating transport modeling and related data activities. Evidence suggests that duplicative efforts and dangerous gaps abound across the site in this broad and vital area. It is essential that integration be vigorously applied to all important aspects of modeling and related data activities, and it seems reasonable that the IP should be assigned the responsibility to accomplish this.

The success of the recent S&T effort demonstrates the power of synergistic workshops involving experts from across the nation. The resulting plans are robust and generally enjoy a high level of credibility. Workshops in specific technical areas, such as vadose zone modeling and decision-making under uncertainty, should yield similar benefits if they are well designed.

It is our view that interaction between IP participants and the IPEP can and must be further improved. We ask IP participants to work with us to identify early schedule points where IPEP involvement can have maximum benefit and cause minimum disruption. We ask IP participants to provide constructive feedback regarding IPEP plans for FY00 regarding areas of focus and planned activities. We encourage constructive criticism of our activities and products from IP personnel, from stakeholders, and from the Tribal Nations. We also encourage anyone who has concerns about the IP to convey those concerns to us, either during the public input parts of our meetings, or better still, in the form of written or emailed comments.

IPEP members have concluded that in some cases the most efficient use of our limited time is for us to monitor, and sometimes establish liaisons with, external review groups that are brought in; an example is our liaison with the Peer Review Panel on the Proposed Hanford Site-Wide Groundwater Model. However, it is not unusual for us to learn after the fact that external reviews have been performed, but without learning anything of the results, such as in the case of an external borehole logging review conducted last summer. This lack of consistent communication on important issues about which the IPEP should be informed, in our view, must be addressed. While we do receive some meeting minutes by email, this is not the same as direct notification regarding these important events.

In an earlier IPEP meeting closeout report, we commented that planning is not progress, but rather a prelude to progress (IPEP, 1999a). Even flawless planning by the IP would contribute nothing to the Hanford Site mission until that planning is implemented successfully. While planning will be with us throughout the duration of the IP, in the view of the IPEP, the emphasis must now be on moving from the prelude to real progress that contributes to the Hanford Site mission in measurable and valuable ways.

Recommendations

1. We recommend that IP managers resolve the objectives and potential uses of the SAC, Rev. 0, as quickly as possible. If feasible, we recommend that they put forward a plan that allows at least some use of Rev. 0 in decision making.

2. Because the S&T effort has now been through one cycle of the process of identifying needs, issuing requests for proposals, and selecting proposals for funding, we recommend an analysis be performed and published of lessons learned throughout that process, with the goal of identifying and documenting areas of future improvement. Included should be an updated development schedule with revised priorities and specifics regarding how important S&T work that will not be funded through the EMSP process will be handled.

3. We recommend the IP report on how well the EMSP awards have addressed the SAC's most urgent technical and data needs and whether any new gaps have been identified in terms of delivery of modeling technology and data from the S&T effort and methods to integrate information from disparate sources in ways that will intelligently guide the IP.

4. The IP should formalize the process of identifying essential S&T needs not addressed by EMSP funding, including needs of other projects, and ensure that required funding is secured. Important examples include development of specialized drilling and sampling technologies.

5. We recommend that the IP develop a proposal to address the problems identified by the Peer Review Panel on the Proposed Hanford Site-Wide Groundwater Model (Gorelick et al., 1999) regarding deficiencies of the Hanford Environmental Information System and their recommendation "… that a better mechanism be established for the entire Hanford complex to centralize data."

6. We support the goal of developing a single site-wide conceptual model that is allowed to evolve along a single path under configuration control, and recommend that the IP pursue this goal vigorously.

7. We recommend that the IP develop a proposal to integrate (in the broadest sense of the word) computational transport modeling across the site over a period of several years so eventually there is a single center of modeling excellence that handles or at least coordinates most of the transport modeling work. This integration should include developing and maintaining common data bases,

adapting the models to use as much of the same data from those data bases as possible, coordinating the process of defining the needs for specific data that could be obtained by the various field data collection activities, and ensuring that the output from, say, a vadose zone transport model, is useful and suitable as input to a groundwater model.

8. We recommend that the IP hold workshops in key technical areas where differing opinions are the norm, such as vadose zone modeling and decision-making under uncertainty. The workshops should be designed to bring in a broad range of fresh ideas and state-of-the-art technologies and yield unbiased conclusions to the extent practicable, eschewing the "not invented here" attitude.

9. The IP should more vigorously address cost savings, engaging outside experts to assist in defining potential savings where it makes sense to do so. Three areas that deserve immediate, vigorous attention are the cost of bureaucratic overhead, the high cost of drilling, and the expensive groundwater monitoring program.

10. We recommend that IP management work proactively with the Panel to improve communication and interaction between IP participants and the IPEP, remove institutional barriers that reduce IPEP effectiveness, and identify early schedule points where IPEP involvement can have maximum benefit and cause minimum disruption.

11. While the current IPEP point-of-contact at Hanford responds ably to our requests, we recommend that she or another person be assigned the active responsibility of keeping IPEP members apprised, in a timely manner, of peer review activities, workshops, release or impending release of major documents, major decisions or impending decisions, and similar events that have a significant bearing on the IP and related activities.

References

Conaway, J.G., R.J. Luxmoore, J.M. Matuszek, and R.O. Patt, 1997. TWRS Vadose Zone Contamination Issue Expert Panel Status Report, DOE/RL-97-49, April 1997.

Conaway, J.G., R.J. Luxmoore, J.M. Matuszek, R.O. Patt, and P.J. Wierenga,1998. Vadose Zone Expert Panel Meeting Closeout Report, June 23 – 25 1998. DOE/RL-98-67.

DOE, 1998. Groundwater/Vadose Zone Integration Project Specification, DOE/RL-98-48, Draft C.

DOE, 1999a. Groundwater/Vadose Zone Integration Project Science and Technology Summary Description, DOE/RL-98-48, Vol. III, Rev. 0.

DOE, 1999b. Richland Environmental Restoration Project Fiscal Year 2000-2002 Detailed Work Plan: Groundwater/Vadose Zone Integration Projects. DOE/RL-97-44, Rev. 2, Vol. 3, Oct. 1 1999

Gorelick, S., C. Andrews, and J. Mercer, 1999. Summary of site visit meeting June 22 – 23 1999, Letter report to D. Hildebrand, USDOE, July 14 1999.

IPEP, 1999a. Integration Project Expert Panel: Closeout report from November 19 – 21 1998 Expert Panel meeting.

IPEP, 1999b. Integration Project Expert Panel Field Investigations Subpanel: Closeout and followup report – March 22-23 1999 meeting.

IPEP, 1999c. Integration Project Expert Panel Peer Review Processes Subpanel: Closeout report for Subpanel meeting of March 24 1999.

IPEP, 1999d. Integration Project Expert Panel Risk Subpanel: Closeout report for Subpanel meeting of April 30 1999.

Williams, C.V., G.J. Lockwood, R.A. Norman, D.A. Myers, M.G. Gardner, T. Williamson and J. Huffman, 1999. Environmental Measurement-While-Drilling System and Horizontal Directional Drilling Technology Demonstration, Hanford Site, Sandia National Laboratory Report SAND99-1479, June 1999.

Price, R., 1996. Evaluation of historical dry well surveillance logs, Westinghouse Hanford Co. Report WHC-SD-ENV-TI-001, Rev. 0.

Appendix:
Measures of IPEP Success

At one point in the September meeting, one of the IPEP members asked the question: What would constitute success for the IP? During the ensuing discussion, the IPEP in turn was asked, what would constitute success for the Panel?

In the long run, IPEP success is fundamentally tied to IP success. This does not necessarily require the success of any given person, group, or organization structure within the IP, but rather requires that true, useful integration be achieved in a timely and cost effective way. The IPEP must contribute to this IP success in substantive and widely recognized ways. Some indicators include:

- positive effect on key plans, processes, and products,
- value-added input for Hanford management and staff (short-term, intermediate term, and long-term), and
- identification of potential cost savings, technical improvements, and efficiencies.

In addition to the above indicators of success for the IPEP, we identified two more criteria that are vital:

- support from DOE-HQ and Hanford Site senior management, and
- support from the stakeholders, regulators, and Tribal Nations.

The presence of this support is not a true indicator of success for the IPEP, but the absence of support from any of these groups would render our jobs much more difficult and may make success unachievable. Similarly, success for the IPEP is unlikely without solid support and cooperation from Integration Project personnel at all levels.

From the stakeholders, Tribal Nations, and regulators, the IPEP for the most part has received expressions of support, which we consider an indication of success, at least for the present. But in various ways, it is also clear that we, too, are under scrutiny. We understand and welcome that scrutiny, but we ask something in return: we ask for help.

As an external and independent review group, our involvement in this process is in the form of perhaps two weeks of work, a few times per year, most of it off-site. As such, we cannot hope to match the depth and breadth of experience and understanding represented by the many other interested parties who are more closely involved. Perhaps unavoidably, some of the more subtle but nonetheless important nuances will escape our attention. So we ask the stakeholders, the Tribal Nations, as well as IP personnel, to give us the benefits of your diverse viewpoints on an ongoing basis. We also encourage anyone who has concerns about the IP to convey those concerns to us, either during the public input parts of our meetings, or better still, in the form of written or emailed comments. Finally, we solicit and encourage constructive criticism of our activities and products from all parties, including DOE, contractors, the Tribal Nations, regulators, and other stakeholders.